

**FINAL REPORT
DECEMBER 2004**



REPORT NO. 04-04

**TRANSPORTABILITY TESTING
OF THE M872 A4 SEMI TRAILER,
TP-94-01,
“TRANSPORTABILITY TESTING PROCEDURES”**

Prepared for:

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**VALIDATION ENGINEERING DIVISION
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TRANSPORTABILITY TESTING OF THE
M872 A4 SEMI TRAILER, TP-94-01, REV. 2, JUNE 2004
"TRANSPORTABILITY TESTING PROCEDURES"

DECEMBER 2004

ABSTRACT

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Program Manager Trailers to conduct transportability testing on the M872 A4 Semi Trailer manufactured by Talbert, Rensselaer, Indiana. The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures."

The objective of the testing was to evaluate the M872 A4 Semi Trailer when transportability tested in accordance with TP-94-01, Revision 2, June 2004.

The M872 A4 semi trailer tie-down rings and anchors performed adequately during testing.

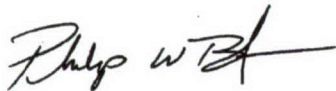
However, as currently designed the M872 A4 semi trailer is **not adequate** for transport of bulk ammunition. The design of the side and center channels created problems during loading and transport of the ammunition loads. For example, during transport the foot of the Multiple Launch Rocket System (MLRS) pod slid into the side channel of the trailer. This caused the foot to rotate and could lead to damage to the MLRS pod or the pod foot. The pallet skids for the wood pallets and the metal pallets overhung the side channel. This situation could cause damage to the skid, load shifting and create a loose and unsafe load.

The 155MM Separate Loading Projectiles (SLP) had to be reduced from six pallets per row to five pallets per row. The row of six wide rested on the trailer rings and made them inoperable. Drawing 1948 4901/1 "Loading Tie Down, and

Unloading Procedures for Separate Loading Projectiles in/on Tactical Vehicles,” page 18, shows six pallets per row. The reduction in the quantity per row could reduce the payload of 155MM SLP from 84 to 70 pallets, a reduction of 112 rounds, for shipments with the trailer in the current configuration. Also, the 155MM SLP pallets are traditionally banded in groups of three. Changing the rows from six pallets to five pallets wide will require that the banded groups be broken and loaded individually. Therefore, loading efficiency will be greatly reduced.

Also, care needs to be taken with the length of the deck boards on the trailer. All rings in the center channels could not be placed flat in all orientations due to interference with the deck boards.

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**VALIDATION ENGINEERING DIVISION
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REPORT NO. 04-04

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TP-94-01, REVISION 2, JUNE 2004 "TRANSPORTABILITY TESTING
PROCEDURES"**

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PART 1 – INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Program Manager Trailers to conduct transportability testing on the M872 A4 Semi Trailer manufactured by Talbert, Rensselaer, Indiana. The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures."

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Joint Munitions Command (JMC), Rock Island, IL. Reference is made to the following:

1. AR 740-1, 15 June 2001, Storage and Supply Activity Operation.
2. OSC-R, 10-23, Mission and Major Functions of U.S. Army Defense Ammunition Center (DAC) 21 Nov 2000.

C. OBJECTIVE. The objective of the testing was to evaluate the M872 A4 Semi Trailer, when transportability tested in accordance with TP-94-01, Revision 2, June 2004.

D. CONCLUSION. The M872 A4 semi trailer tie-down rings and anchors performed adequately during testing.

However, as currently designed the M872 A4 semi trailer is **not adequate** for transport of bulk ammunition. The design of the side and center channels created problems during loading and transport of the ammunition loads. For example, during transport the foot of the Multiple Launch Rocket System (MLRS) pod slid into the side channel of the trailer. This caused the foot to rotate and could lead to damage to the MLRS pod or the pod foot. The pallet skids for the wood pallets and the metal pallets

overhung the side channel. This situation could cause damage to the skid, load shifting and create a loose and unsafe load.

The 155MM Separate Loading Projectiles (SLPs) had to be reduced from six pallets per row to five pallets per row. The row of six wide rested on the trailer rings and made them inoperable. Drawing 1948 4901/1 "Loading Tie Down, and Unloading Procedures for Separate Loading Projectiles in/on Tactical Vehicles," page 18, shows six pallets per row. The reduction in the quantity per row could reduce the payload of 155MM SLP from 84 to 70 pallets, a reduction of 112 rounds, for shipments with the trailer in the current configuration. Also, the 155MM SLP pallets are traditionally banded in groups of three. Changing the rows from six pallets to five pallets wide will require that the banded groups be broken and loaded individually. Therefore, loading efficiency will be greatly reduced.

Also, care needs to be taken with the length of the deck boards on the trailer. All rings in the center channels could not be placed flat in all orientations due to interference with the deck boards.

PART 2 - ATTENDEES

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PART 3 - TEST EQUIPMENT

1. M872 A4 Semi Trailer

Manufactured by: Talbert Manufacturing Inc., Rensselaer, Indiana

Date of Manufacture: 1/16/2004

VIN 40FEO 443241022953

Capacity: 34 ton

Weight: 18,694 pounds

2. Truck, Tractor

5-Ton, 6 X 6

Model #: XM818 without winch

ID #: 05E-37770-C124-12331

Weight: 19,260 pounds

3. Truck, Tractor

5 Ton, 6 X 6

Model #: XM818 with winch

Manufactured by General Products Division, Jeep Corporation

ID #: 05A-74971-C124-13529

Weight: 20,955 pounds

PART 4 - TEST PROCEDURES

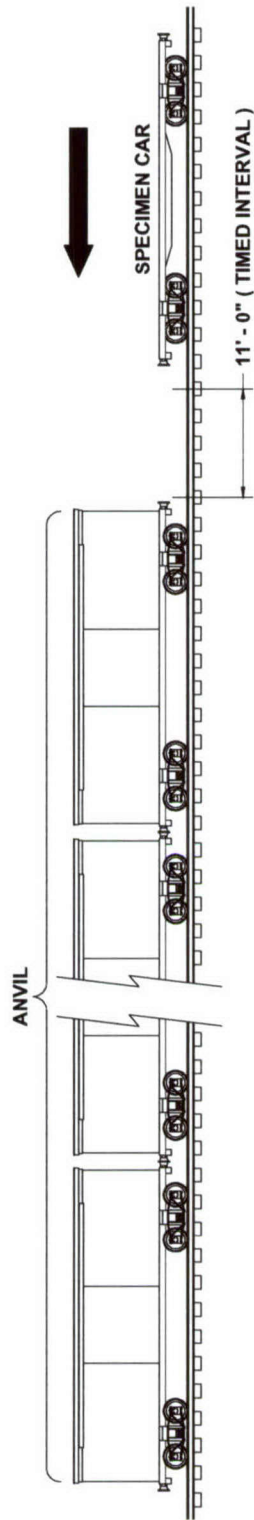
The test procedures outlined in this section were extracted from TP-94-01, "Transportability Testing Procedures," Revision 2, June 2004, for validating tactical vehicles and outloading procedures used for shipping munitions by tactical truck, railcar, and ocean-going vessel.

Inert (non-explosive) items were used to build the load. The test loads were prepared using the blocking and bracing procedures proposed for use with munitions (**see Part 6 for procedures**). The weight and physical characteristics (weights, physical dimensions, center of gravity, etc.) of the test loads were similar to live (explosive) ammunition. The following tests identified are normally required for transportability certification. However, not all tests will be required for some specific items.

A. RAIL TEST. RAIL IMPACT TEST METHOD. The test load or vehicle will be secured to a flatcar. The equipment needed to perform the test will include the specimen (hammer) car, four empty railroad cars connected together to serve as the anvil, and a railroad locomotive. The anvil cars will be positioned on a level section of track with air and hand brakes set and with draft gears compressed. The locomotive unit will push the specimen car toward the anvil at a predetermined speed, then disconnect from the specimen car approximately 50 yards away from the anvil cars allowing the specimen car to roll freely along the track until it strikes the anvil. This will constitute an impact. Impacting will be accomplished at speeds of 4, 6, and 8.1 mph in one direction and at a speed of 8.1 mph in the reverse direction. The tolerance for the speeds is plus 0.5 mph, minus 0.5 mph for the 4 mph and 6 mph impacts, and plus 0.5 mph, minus 0 mph for the 8.1 mph impacts. The impact speeds will be determined by using an electronic counter to measure the time for the specimen car to traverse an 11-foot distance immediately prior to contact with the anvil cars (see Figure 1).

ASSOCIATION OF AMERICAN RAILROADS (AAR)

STANDARD TEST PLAN



4 BUFFER CARS (ANVIL)

WITH DRAFT GEAR COMPRESSED AND AIR
BRAKES IN A SET POSITION

ANVIL CAR TOTAL WT. 250,000 LBS (APPROX)

SPECIMEN CAR IS RELEASED BY SWITCH ENGINE
TO ATTAIN: IMPACT NO. 1 @ 4 MPH

IMPACT NO. 2 @ 6 MPH

IMPACT NO. 3 @ 8.1 MPH

THEN THE CAR IS REVERSED AND RELEASED BY
SWITCH ENGINE TO ATTAIN:

IMPACT NO. 4 @ 8.1 MPH

Figure 1. Rail Impact Sketch

B. ON/OFF ROAD TEST.

1. **HAZARD COURSE.** The test load or vehicle will be transported over the 200-foot-long segment of concrete-paved road consisting of two series of railroad ties projecting 6 inches above the level of the road surface. The hazard course will be traversed two times (see Figure 2).

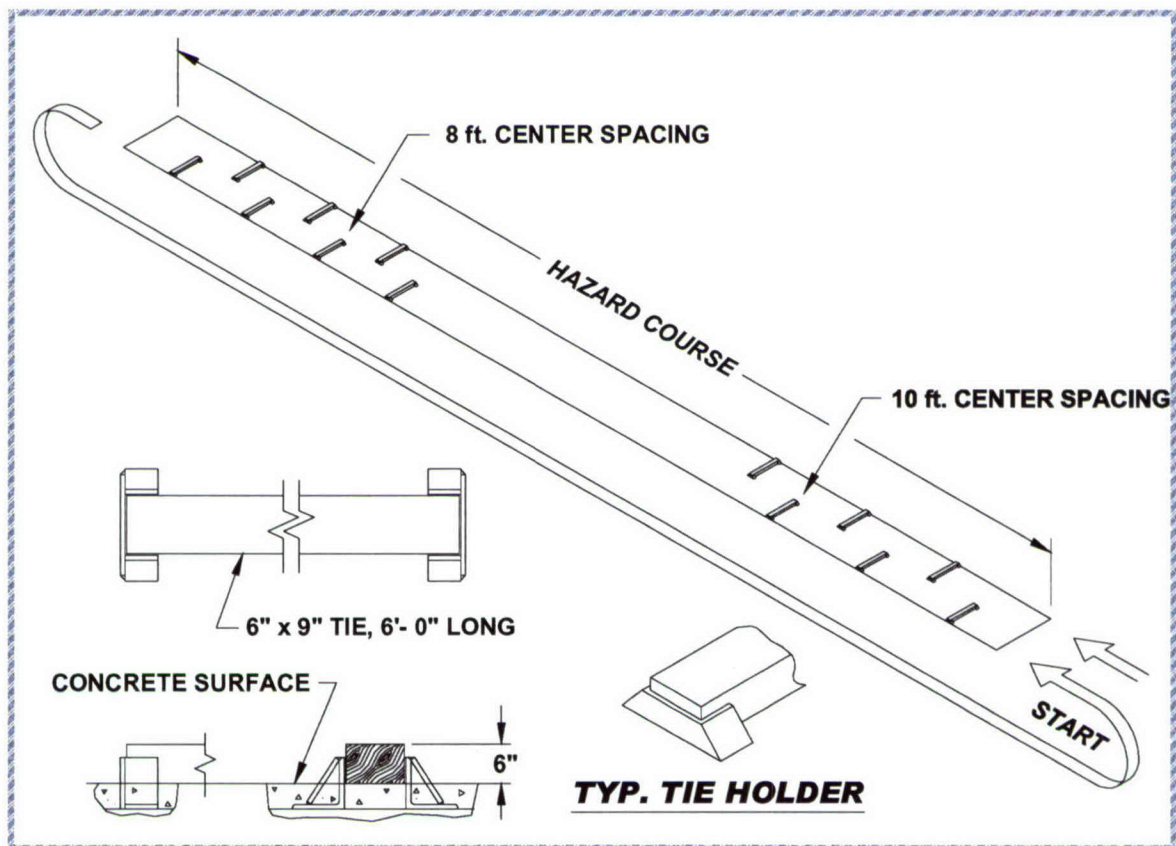


Figure 2. Hazard Course Sketch

- a. The first series of 6 ties are spaced on 10-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 50 feet.
- b. Following the first series of ties, a paved roadway of 75 feet separates the first and second series of railroad ties.

c. The second series of 7 ties are spaced on 8-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 48 feet.

d. The test load is driven across the hazard course at speeds that will produce the most violent vertical and side-to-side rolling reaction obtainable in traversing the hazard course (approximately 5 mph).

2. ROAD TRIP. The test load or vehicle will be transported for a distance of 30 miles over a combination of roads surfaced with gravel, concrete, and asphalt. The test route will include curves, corners, railroad crossings and stops and starts. The test load or vehicle will travel at the maximum speed for the particular road being traversed, except as limited by legal restrictions.

3. PANIC STOPS. During the road trip, the test load or vehicle will be subjected to three (3) full airbrake stops while traveling in the forward direction and one in the reverse direction while traveling down a 7 percent grade. The first three stops are at 5, 10, and 15 mph while the stop in the reverse direction is approximately 5 mph. This testing will not be required if the Rail Impact Test is performed.

4. WASHBOARD COURSE. The test load or vehicle will be driven over the washboard course (see Figure 3) at a speed that produces the most violent response in the vertical direction.

C. OCEAN-GOING VESSEL TEST. 80-DEGREE TILT TEST. The test load (specimen) shall be positioned on level terrain with the bottom corner fittings resting on timbers so the entire container is supported solely by the bottom corner fittings. The timbers shall be oriented parallel to the end rails of the container and extend 2 feet beyond the corner fittings on each side. Using two mobile cranes and appropriate rigging, the container shall be rotated (tilted) using the bottom corner fittings on one side as a fulcrum. The rigging (slings) of one

crane shall be attached to the bottom corner fittings of the long side and the rigging (slings) of the second crane shall be attached to the top corner fittings on the opposite side. The tilting shall be accomplished by lifting the bottom corner fittings with the first crane so the container rotates about the opposite bottom corner fittings (fulcrum). Lifting/rotating by the first crane is continued until the center of gravity passes over the fulcrum, at which point the second crane shall provide support to the container and lower the container to the 80 degrees, plus or minus 2 degrees position. Rotation shall be accomplished smoothly at a slow speed so the container sidewall is subjected only to the static force of the interior load. The crane booms shall be adjusted to maintain a rear vertical suspension of the rigging at all times. In the case of end-opening type containers, at least one door (lower side of tilted container) must be closed and fastened throughout the test. The container shall be held in the tilted position for a minimum of two minutes. At which time, observations of both the container structure and the interior load shall be made. When the test is completed, the container shall be returned to its upright position using the same manner and care in handling.

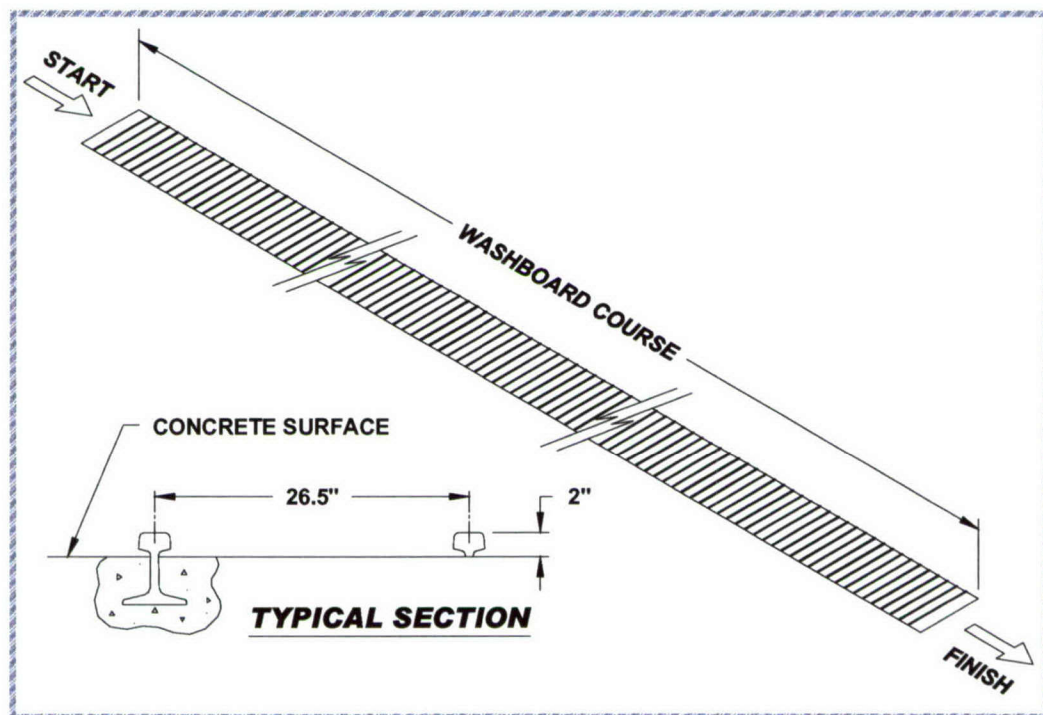


Figure 3. Washboard Course Sketch

PART 5 - TEST RESULTS

5.1

Testing Date: 28 October 2004

Test Specimen: M872 A4 Semi Trailer

Payload: Two MLRS Pods

Test Gross Weight: 48,640 pounds (including the M872 A4 semi trailer, M818 tractor and the MLRS Pods)

Payload Weight: 10,480 pounds

Notes:

- a. Wood dunnage was used to fill the trailer side and center channels and to assist in supporting the MLRS pod feet.
- b. Initial inspection revealed that the center tie-down rings could not be placed flat in all orientations. This was due to interference with the trailer deck boards. The length of the deck boards should be controlled so as not to interfere with the storage of the tie-down rings.



Photo 1. MLRS Pods on the M872 A4 Semi Trailer

A. ON/OFF ROAD TESTS.

1. HAZARD COURSE.



**Photo 2. Hazard Course Testing of the M872 A4 Semi Trailer
with the MLRS Pods**

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	31 Seconds	5.0
2	29 Seconds	5.3

Figure 4.

Remarks:

1. Figure 4 lists the average speeds of the test load through the Hazard Course.
2. Inspection following the completion of Pass #1 revealed that the pods moved 0-1 inch toward the rear of the trailer and 0.25-1 inch toward the driver's side.
3. Inspection following the completion of Pass #2 revealed the pods had moved 0-1.5 inches toward the front of the trailer and 0.75-1 inches toward the driver's side. The wood filler at the passenger rear was removed, for safety reasons,

prior to starting the Road Trip due to the fact that it was delaminating and no longer supporting the pod foot.

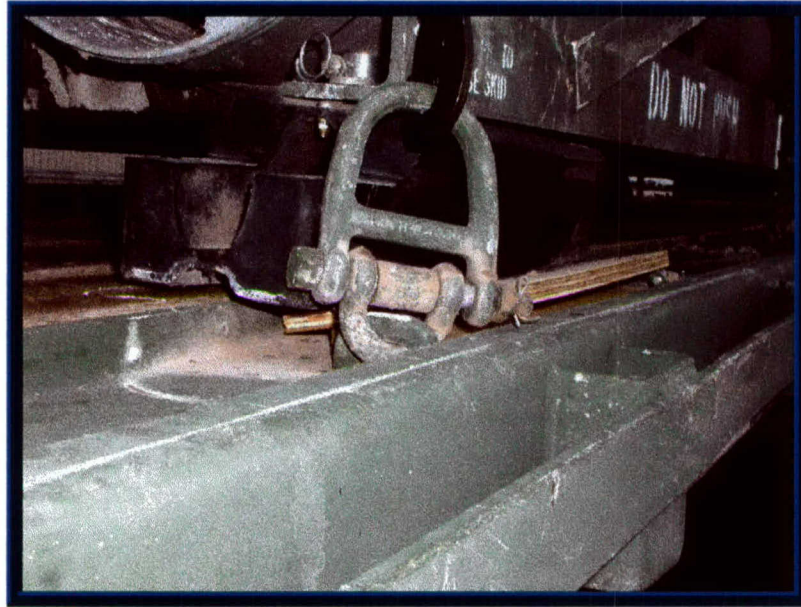


Photo 3. Delamination of Wood Dunnage

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the Road Trip revealed no movement of the payload.

3. PANIC STOPS:

Remarks:

1. The panic stops were conducted during the Road Trip.
2. Inspection following the completion of the forward 5 mph stop revealed that the pods moved 11 inches toward the front of the trailer.
3. Inspection following the completion of the reverse 5 mph stop revealed that the pods moved 9 inches toward the rear of the trailer.



Photo 4. Movement of Pods During Forward Panic Stop

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	26 Seconds	5.9
4	26 Seconds	5.9

Figure 5.

Remarks:

1. Figure 5 lists the average speeds of the test load through the Hazard Course.
2. Inspection following the completion of Pass #3 revealed that the pods had moved 1 inch toward the driver's side.
3. Inspection following Pass #4 revealed that the pods had moved 0.5 inches toward the rear of the trailer.

5. WASHBOARD COURSE:

Remark: Inspection following the completion of the Washboard Course revealed that the pods moved 2.5 inches toward the front of the trailer and an additional 1.5 inches toward the driver's side.



Photo 5. Washboard Course Testing of the M872 A4 Semi Trailer with the MLRS Pods.



Photo 6. Entrapment of MLRS Pod Foot in Side Channel

B. CONCLUSION:

1. The MLRS pod foot on the front driver's side became entrapped in the trailer side channel. The MLRS pod foot rotated and this situation could cause damage to the pod foot or pod itself, or cause an unsafe loose load. The trailer, as tested, with the channel is not acceptable for the transport of bulk ammunition.

2. The bracket that supported the container guide on the passenger side of the trailer disengaged and allowed the guide to drop down. The guide was removed due to damage during additional transportability testing.

3. The movement of the MLRS pod in the fore and aft direction during testing was excessive. Additional strapping or dunnage should be considered to resolve the problem.

4. The wood dunnage delaminated during the testing and as designed, is not adequate to support the load.

5. The semi trailer tie-down rings and anchors performed adequately during testing.

5.2

Testing Date: 2 November 2004

Test Specimen: M872 A4 Semi Trailer

Payload: Six Pallets of 120MM Tank Ammunition

Test Gross Weight: 52,820 pounds (including the M872 A4 semi trailer, M818 tractor, and the 120MM Tank Ammunition)

Payload Weight: 14,660 pounds

Note: Aluminum tubing, 1" x 2" x 44" (1/8" wall thickness) was used, in the trailer side channels, to help support the pallet skids. The tubing had a hole drilled approximately 1" from each end and was wired to the tie-down anchors on the trailer. This prevented movement of the tubing during testing.



Photo 7. 120MM Tank Ammunition on the M872 A4 Semi Trailer

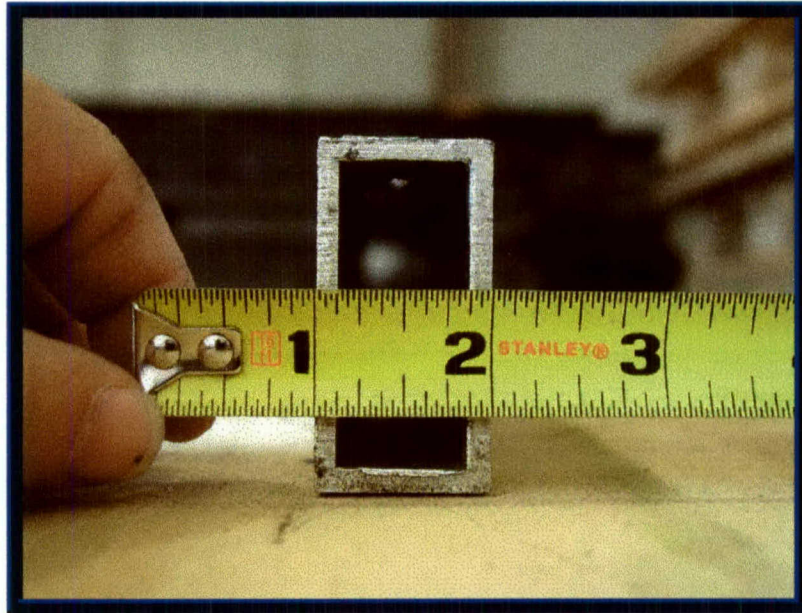


Photo 8. Height of Aluminum Tubing

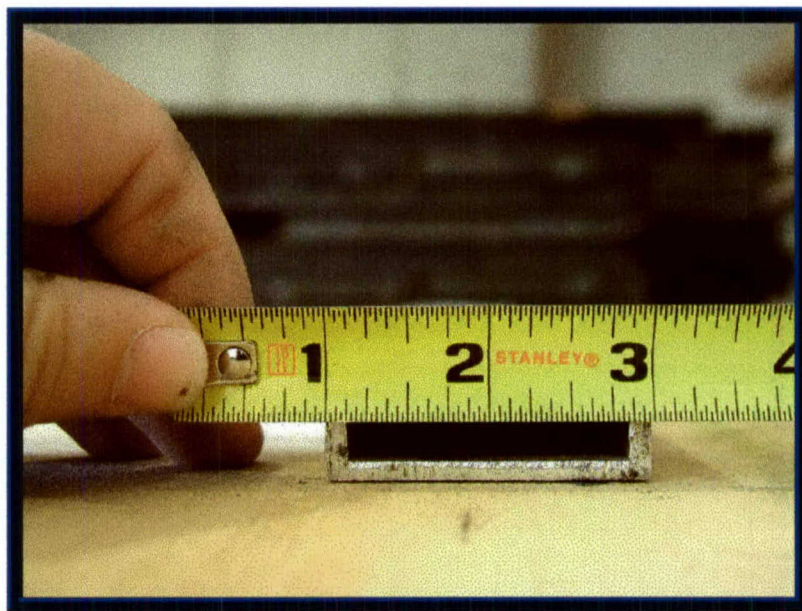


Photo 9. Width of Aluminum Tubing



Photo 10. Example of Aluminum Tubing Wired to Tie-Down Anchors

A. ON/OFF ROAD TESTS.

1. HAZARD COURSE.



**Photo11. Hazard Course Testing of the M872 A4 Semi Trailer
with the 120MM Tank Ammunition**

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	22 Seconds	5.4
2	33 Seconds	4.7

Figure 6.

Remarks:

1. Figure 6 lists the average speeds of the test load through the Hazard Course.
2. Inspections following Pass #1 revealed that the rear pallets moved 0-0.5 inches toward the rear of the trailer.
3. Inspection following Pass #2 revealed that the pallets moved 0-0.25 inches toward the passenger side of the trailer.

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the completion of the Road Trip revealed no additional movement.

3. PANIC STOPS:

Remarks:

1. The panic stops were performed during the Road Trip.
2. Inspection following the completion of the forward 10 mph stop revealed that the pallets moved 1.0 inch toward the front of the trailer.
3. Inspection following the completion of the reverse 5 mph stop revealed that the pallets moved 3.0-3.5 inches toward the rear of the trailer.

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	30 Seconds	5.1
4	29 Seconds	5.3

Figure 7.

Remarks:

1. Figure 7 lists the average speeds of the test load through the Hazard Course.
2. Inspection following Pass #3 revealed that the pallets moved 1.5 inches toward the front of the trailer.
3. Inspection following Pass #4 revealed that the center pallets moved 2.5-3.25 inches toward the passenger side of the trailer.



Photo 12. Movement of the Center Pallets and Aluminum Tubing Supporting the Pallets

5. WASHBOARD COURSE:

Remark: Inspection following the completion of the Washboard Course testing revealed that the pallets moved 0-0.5 inches toward the front of the trailer.



Photo 13. Washboard Course Testing of the M872 A4 Semi Trailer with the 120MM Tank Ammunition

D. CONCLUSION:

1. The pallet skids of the 120MM tank ammunition overhung the side channel. This situation could cause shifting or damage the skid and create a loose and unsafe load. The trailer, as tested, with the channel is not acceptable for the transport of bulk ammunition.
2. The aluminum tubing that was used during testing performed adequately. The tubing provided support to the pallets and remained in place during testing.
3. The semi trailer tie-down ring and anchors performed adequately during testing.

5.3

Testing Date: 3 November 2004

Test Specimen: M872 A4 Semi Trailer

Payload: Fifteen Pallets of 155MM Separate Loading Projectiles

Test Gross Weight: 51,740 pounds (including the M872 A4 semi trailer, M818 tractor and the 120 MM SLP)

Payload Weight: 13,580 pounds

Note: Dunnage was not used in the trailer side channels.



Photo 14. 155 MM SLP on the M872 A4 Semi Trailer

A. ON ROAD TESTS.

1. HAZARD COURSE.



Photo 15. Hazard Course Testing of the M872 A4 Semi Trailer with the 155MM Separate Loading Projectiles

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	26 Seconds	5.9
2	32 Seconds	4.8

Figure 8.

Remarks:

1. Figure lists the average speeds of the test load through the Hazard Course.
2. Inspections following each pass revealed no movement.

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the completion of the Road Trip revealed no movement.

3. PANIC STOPS:

Remarks:

1. The Panic Stops were conducted during the Road Trip.
2. Inspection following the completion of the panic stops revealed no movement.

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	31 Seconds	5.0
4	28 Seconds	5.5

Figure 9.

Remarks:

1. Figure 9 lists the average speeds of the test load through the Hazard Course.
2. Inspections following Pass #4 revealed that the driver's side pallets had moved 0.5 inches toward the rear of the trailer. The center pallets moved 0.375 inches toward the driver's side.

5. WASHBOARD COURSE:

Remark: Inspection following the completion of the Washboard Course testing revealed no additional movement.



Photo 16. Washboard Course Testing of the M872 A4 Semi Trailer with the 155MM Separate Loading Projectiles

B. CONCLUSION:

1. The 155MM SLP had to be reduced from six pallets per row to five pallets per row. The six-wide row rested on the trailer rings and made them inaccessible. Drawing 1948 4901/1 "Loading Tie Down, and Unloading Procedures for Separate Loading Projectiles in/on Tactical Vehicles", page 18 shows six pallets per row. The reduction in the quantity per row could reduce the payload of 155MM SLP from 84 to 70 pallets, a reduction of 112 rounds, for shipment with the trailer in the current configuration. Also, the 155MM SLP pallets are traditionally banded in groups of three. Changing the rows from six pallets to five pallets wide will require that the banded groups be broken and loaded individually. Therefore, loading efficiency will be greatly reduced.

2. The semi trailer tie-down rings and anchors performed adequately during testing.

5.4

Testing Date: 4 November 2004

Test Specimen: M872 A4 Semi Trailer

Payload: Four Pallet Units of C445 Wooden Boxes on Wooden Pallets

Test Gross Weight: 50,320 pounds (including the M872 A4 semi trailer, M818 tractor and the C445 load)

Payload Weight: 12,160 pounds

Note: Aluminum tubing, 1" x 2" x 44" (1/8" wall thickness) was used, in the trailer side channels, to help support the pallet skids. The tubing had a hole drilled approximately 1" from each end and was wired to the tie-down anchors on the trailer. This provided an expanded deck width necessary to support pallet bottom deck boards.



Photo 17. C445 Load on the M872 A4 Semi Trailer

A. ON ROAD TESTS.

1. HAZARD COURSE.



**Photo 18. Hazard Course Testing of the M872 A4 Semi Trailer
with the C445 Load**

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	31 Seconds	5.0
2	27 Seconds	5.7

Figure 10.

Remarks:

1. Figure 10 lists the average speeds of the test load through the Hazard Course.
2. Inspection following the completion of Pass #1 revealed that the pallets on the passenger rear had moved 0.75 inches toward the front of the trailer.
3. Inspection following the completion of Pass #2 revealed that the pallets had moved 0.75 inches toward the front of the trailer.

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the completion of the road trip revealed no additional movement.

3. PANIC STOPS:

Remarks:

1. The Panic Stops were conducted during the Road Trip.
2. Inspection following the completion of the forward 5 mph stop revealed that the pallets moved 0.5 inches on the passenger side toward the front of the trailer.
3. Inspection following the completion of the forward 10 mph stop revealed that the pallets moved 0.5 inches on the passenger and driver's side toward the front of the trailer.
4. Inspection following the completion of the reverse 5 mph stop revealed that the pods moved 2 inches on the driver's side toward the rear and 0.5 inches on the passenger side toward the rear of the trailer.

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	29 Seconds	5.3
4	26 Seconds	5.9

Figure 11.

Remarks:

1. Figure 11 lists the average speeds of the test load through the Hazard Course.
2. Inspection following Pass #3 revealed the pallets had moved 0.25 inches toward the front of the trailer.

5. WASHBOARD COURSE:

Remark: Inspection following the completion of the Washboard Course testing revealed that the pallets moved 0.5 inches toward the passenger side and 0.25 inches toward the rear on the driver's side and 1.5 inches toward the front of the trailer on the passenger side.



Photo 19. Washboard Course Testing of the M872 A4 Semi Trailer with the C445 Load

B. CONCLUSION:

1. The pallet skids of the C445 boxed ammunition overhung the side channel. This situation could cause shifting or damage the skid and crate a loose and unsafe load. The trailer, as tested, with the channel is not acceptable for the transport of bulk ammunition.
2. The aluminum tubing that was used during testing performed adequately. The tubing provided support to the pallets and remained in place during testing.
3. The semi trailer tie-down rings and anchors performed adequately during testing.

PART 6– DRAWINGS

The following drawings were used as guidance for the tie-down procedures for the test loads that were subjected to the test criteria.

MLRS

LOADING, TIEDOWN, AND UNLOADING PROCEDURES FOR THE ROCKET POD/CONTAINER (RP/C) FOR THE MULTIPLE LAUNCH ROCKET SYSTEM IN/ON TACTICAL VEHICLES

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U.S. ARMY MATERIEL COMMAND DRAWING

APPROVED, U.S. ARMY MISSILE COMMAND

[Signature]

APPROVED BY ORDER OF COMMANDING GENERAL, U.S.
ARMY MATERIEL COMMAND

[Signature]
U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL

REVISION NO. 2

APRIL 1995

SEE THE REVISION LISTING ON PAGE 3

DRAFTSMAN

B. LEONARD

TECHNICIAN

ENGINEER

J. SIMONS

VALIDATION
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TRANSPORTATION
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DIVISION

LOGISTICS
ENGINEERING
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FEBRUARY 1982

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DRAWING

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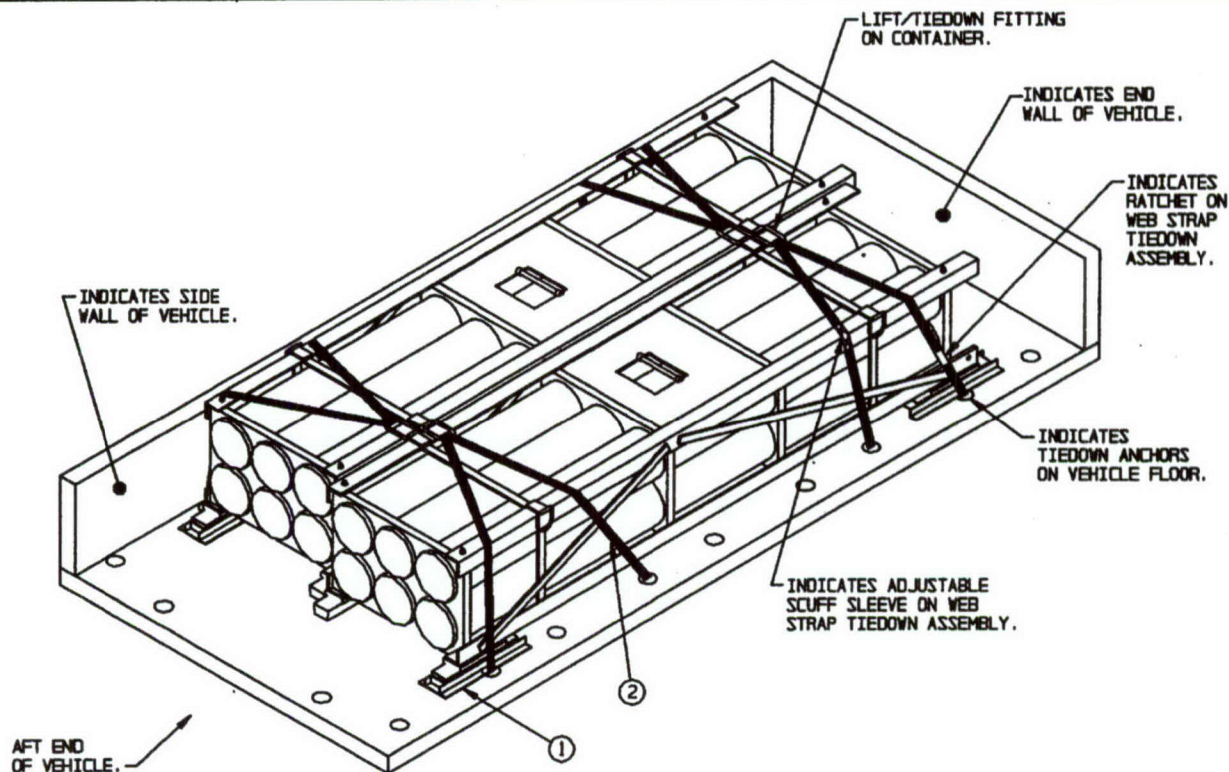
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PROJECT GM 725-80



ISOMETRIC VIEW

SPECIAL NOTES:

1. A LOAD OF TWO CONTAINERS IS SHOWN IN A 10-TON M977/M985 HEAVY EXPANDED MOBILITY TACTICAL TRUCK, HAVING INSIDE DIMENSIONS OF 216-3/8" LONG BY 90-3/4" WIDE, EQUIPPED WITH "SHOE" TYPE RESTRAINING DEVICES AS SHOWN ON PAGE 26.
2. IF THE 10-TON M977/M985 HEMTT IS NOT EQUIPPED WITH THE "SHOE" TYPE RESTRAINING DEVICES USE THE PROCEDURES SHOWN ON PAGE 8 FOR LOADING AND TIEDOWN OF TWO CONTAINERS.
3. WHEN POSITIONING CONTAINERS ON VEHICLES ASSURE THAT LIFTING RINGS ON CONTAINERS ARE OFF-SET LONGITUDINALLY AND RESTING ON TOP OF ADJACENT CONTAINER.
4. A TOTAL OF FOUR WEB STRAP TIEDOWN ASSEMBLIES ARE REQUIRED FOR THE LOAD SHOWN ABOVE.

KEY NUMBERS

- ① SHOE ASSEMBLY (4 REQD). SEE THE DETAIL ON PAGE 26. PRE-POSITION EACH SHOE ASSEMBLY AS SHOWN IN THE "PLAN VIEW OF 10-TON M977/M985 HEMTT" DETAIL ON PAGE 27. SEE LOADING PROCEDURES NOTE 7 ON PAGE 14.
- ② WEB STRAP TIEDOWN ASSEMBLY (4 REQD). HOOK THE END OF THE STRAP THAT HAS THE RATCHET TO THE SECOND TIEDOWN ANCHOR FROM THE AFT END OF THE CARGO DECK, THEN THE HOOK ON THE LONG END OF THE STRAP ASSEMBLY IS PASSED UPWARD AND OVER THE TOP OF THE NEAR CONTAINER TO A LIFT/TIEDOWN FITTING ON THE OPPOSITE CONTAINER, THROUGH THE LIFTING RING FROM THE BOTTOM UP, BACK OVER TOP OF NEAR CONTAINER AND BACK DOWN AND ATTACH THE FORWARD STRAP HOOK TO THE THIRD TIEDOWN ANCHOR FROM THE FORWARD END OF THE CARGO DECK AND ATTACH THE AFT STRAP HOOK TO THE FOURTH TIEDOWN ANCHOR FROM THE AFT END OF THE CARGO DECK. POSITION STRAP SCUFF SLEEVES AT SHARP EDGES. TAKE UP EXCESS SLACK IN STRAP AND RATCHET TIGHT. SEE GENERAL NOTES "D" AND "E". ON PAGE 2.

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
CONTAINER	2	10,156 LBS

LOADING, TIEDOWN, AND UNLOADING PROCEDURES^① FOR PROPELLING CHARGES IN/ON TACTICAL VEHICLES

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① THE PROCEDURES DEPICTED WITHIN THIS DRAWING ARE FOR
OFF-HIGHWAY USE. HOWEVER, THEY MAY ALSO BE USED FOR
ON-HIGHWAY USE, IF DESIRED.

DO NOT SCALE

REVISIONS				DATE	BY	APP'D	CHK'D
				TRR	4h	JDS/WRE	
				CHG		WJ	
				APPROVED, U.S. ARMY AMC, DRAWINGS AND ORIGINALS			
				<i>Robert W. Hadden</i> AMC- TAC-2			
				APPROVED BY CHIEF OF ENGINEERING, U.S. ARMY NATIONAL CENTER (AMC)			
				<i>William F. Ernst</i>			
				U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL			
				U.S. ARMY AMC DRAWING			
				SEPTEMBER 1986			
				CLASS	DIVISION	DRAWING	FILE
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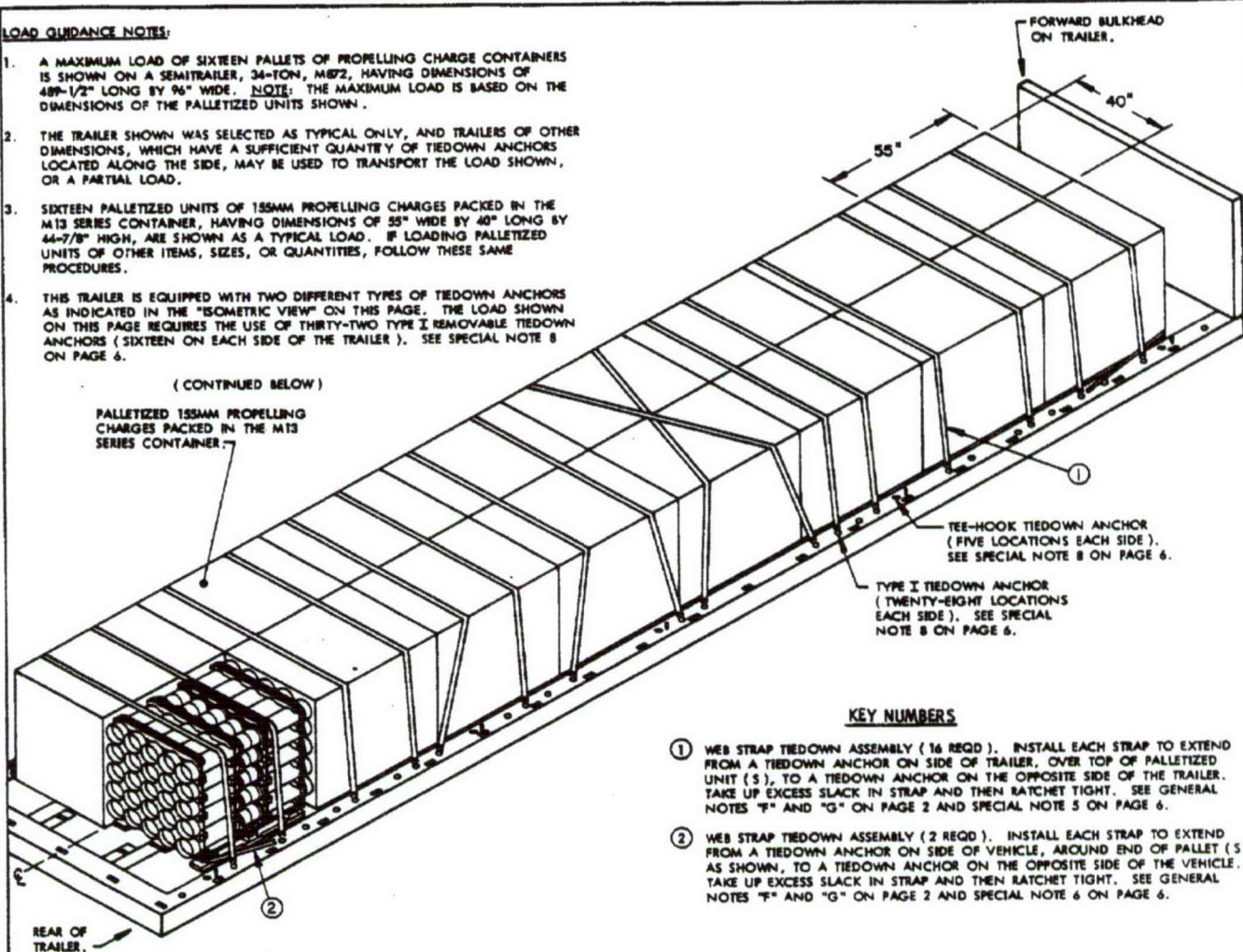
PROJECT CAP-TV 27249

LOAD GUIDANCE NOTES:

1. A MAXIMUM LOAD OF SIXTEEN PALLETIZED PROPELLING CHARGE CONTAINERS IS SHOWN ON A SEMITRAILER, 34-TON, M872, HAVING DIMENSIONS OF 48'-1/2" LONG BY 96" WIDE. **NOTE:** THE MAXIMUM LOAD IS BASED ON THE DIMENSIONS OF THE PALLETIZED UNITS SHOWN.
2. THE TRAILER SHOWN WAS SELECTED AS TYPICAL ONLY, AND TRAILERS OF OTHER DIMENSIONS, WHICH HAVE A SUFFICIENT QUANTITY OF TIEDOWN ANCHORS LOCATED ALONG THE SIDE, MAY BE USED TO TRANSPORT THE LOAD SHOWN, OR A PARTIAL LOAD.
3. SIXTEEN PALLETIZED UNITS OF 155MM PROPELLING CHARGES PACKED IN THE M13 SERIES CONTAINER, HAVING DIMENSIONS OF 55" WIDE BY 40" LONG BY 44-7/8" HIGH, ARE SHOWN AS A TYPICAL LOAD. IF LOADING PALLETIZED UNITS OF OTHER ITEMS, SIZES, OR QUANTITIES, FOLLOW THESE SAME PROCEDURES.
4. THIS TRAILER IS EQUIPPED WITH TWO DIFFERENT TYPES OF TIEDOWN ANCHORS AS INDICATED IN THE "ISOMETRIC VIEW" ON THIS PAGE. THE LOAD SHOWN ON THIS PAGE REQUIRES THE USE OF THIRTY-TWO TYPE I REMOVABLE TIEDOWN ANCHORS (SIXTEEN ON EACH SIDE OF THE TRAILER). SEE SPECIAL NOTE 8 ON PAGE 6.

(CONTINUED BELOW)

PALLETIZED 155MM PROPELLING CHARGES PACKED IN THE M13 SERIES CONTAINER.



ISOMETRIC VIEW

(LOAD GUIDANCE NOTES CONTINUED)

5. A TOTAL OF EIGHTEEN WEB STRAP TIEDOWN ASSEMBLIES ARE REQUIRED FOR THE LOAD SHOWN ABOVE. SEE "LOADING, TIEDOWN, AND UNLOADING PROCEDURES" NOTE 6 ON PAGE 5.
6. IF AN UNEVEN QUANTITY OF PALLETIZED UNITS ARE BEING LOADED, SUCH AS FIFTEEN, POSITION ONE PALLETIZED UNIT IN THE CENTER OF THE TRAILER WIDTH AND TIGHT AGAINST THE REAR TWO LATERALLY ADJACENT PALLETIZED UNITS, AS SHOWN IN THE LOAD ON PAGE 11.
7. WHEN LOADING ONE PALLETIZED UNIT ON A TRAILER, POSITION THE PALLETIZED UNIT IN THE CENTER OF THE TRAILER WIDTH AND IN A LONGITUDINAL LOCATION THAT WILL ALLOW TWO STRAPS TO BE POSITIONED OVER TOP OF THE PALLETIZED UNIT AND ONE STRAP AROUND THE PALLET BASE AT EACH END. USE THE LOAD ON PAGE 10 FOR GUIDANCE.
8. IF IT IS DESIRABLE TO LOAD A ROW OF TWO OR MORE SINGLE PALLETIZED UNITS DOWN THE CENTER OF THE TRAILER LENGTH, USE THE LOAD ON PAGE 10 FOR GUIDANCE. **NOTE:** ONE ADDITIONAL STRAP MARKED ② WILL BE REQUIRED, AROUND THE BASE OF THE PALLET, AT THE FORWARD END OF THE LOAD.

KEY NUMBERS

- ① WEB STRAP TIEDOWN ASSEMBLY (16 REQD). INSTALL EACH STRAP TO EXTEND FROM A TIEDOWN ANCHOR ON SIDE OF TRAILER, OVER TOP OF PALLETIZED UNIT (S), TO A TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE TRAILER. TAKE UP EXCESS SLACK IN STRAP AND THEN RATCHET TIGHT. SEE GENERAL NOTES "F" AND "G" ON PAGE 2 AND SPECIAL NOTE 5 ON PAGE 6.
- ② WEB STRAP TIEDOWN ASSEMBLY (2 REQD). INSTALL EACH STRAP TO EXTEND FROM A TIEDOWN ANCHOR ON SIDE OF VEHICLE, AROUND END OF PALLET (S), AS SHOWN, TO A TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE VEHICLE. TAKE UP EXCESS SLACK IN STRAP AND THEN RATCHET TIGHT. SEE GENERAL NOTES "F" AND "G" ON PAGE 2 AND SPECIAL NOTE 6 ON PAGE 6.

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
PALLETIZED UNITS	16	28,256 LBS

PALLETIZED PROPELLING CHARGE CONTAINERS LOADED ON A SEMITRAILER, 34-TON, M872

PAGE 19

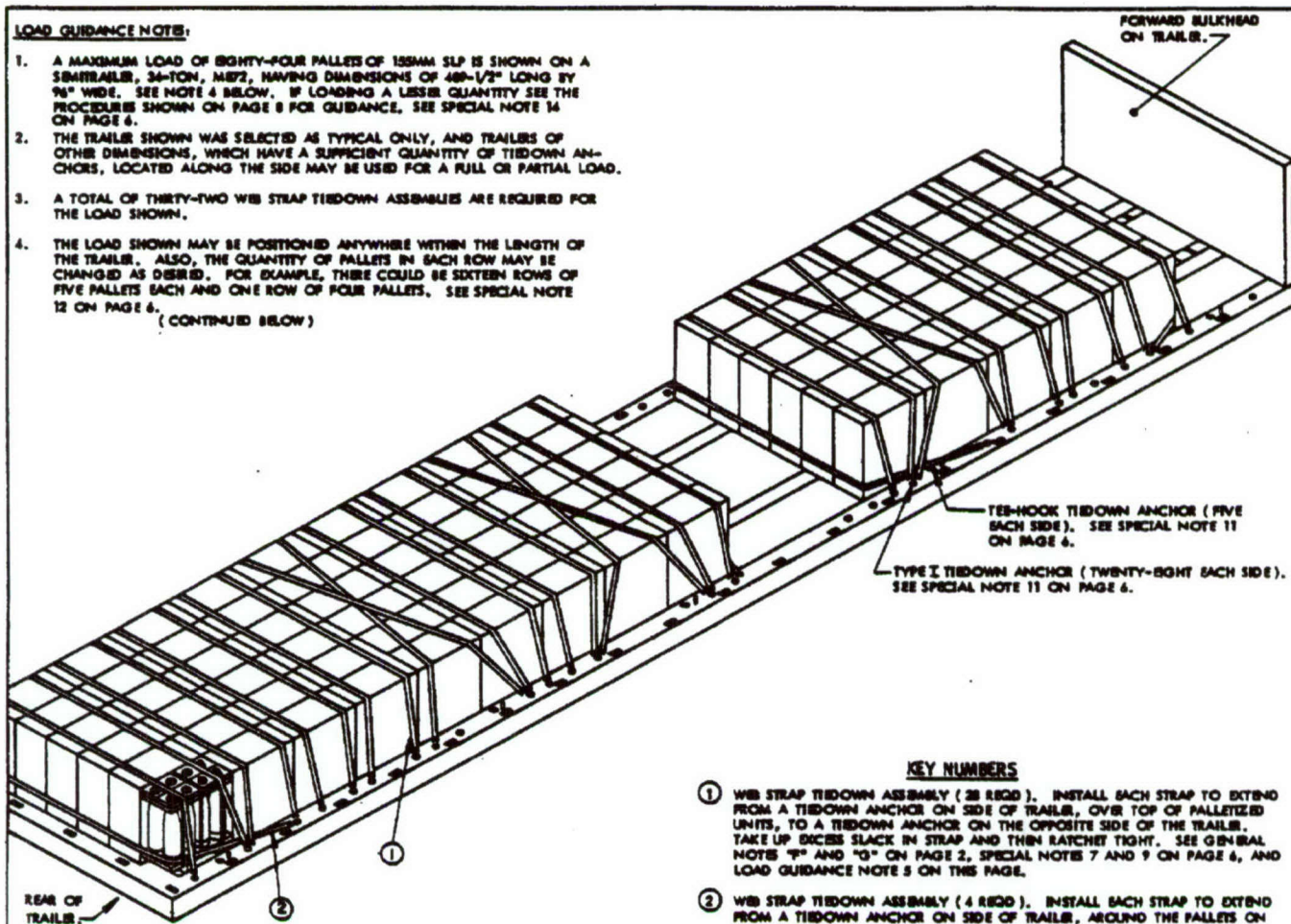
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PROJECT CAP-TV 20-79

LOAD GUIDANCE NOTE:

1. A MAXIMUM LOAD OF EIGHTY-FOUR PALLETS OF 155MM SLP IS SHOWN ON A SEMITRAILER, 34-TON, M872, HAVING DIMENSIONS OF 48'-1/2" LONG BY 76" WIDE. SEE NOTE 4 BELOW. IF LOADING A LESSER QUANTITY SEE THE PROCEDURES SHOWN ON PAGE 8 FOR GUIDANCE. SEE SPECIAL NOTE 14 ON PAGE 6.
2. THE TRAILER SHOWN WAS SELECTED AS TYPICAL ONLY, AND TRAILERS OF OTHER DIMENSIONS, WHICH HAVE A SUFFICIENT QUANTITY OF TIEDOWN ANCHORS, LOCATED ALONG THE SIDE MAY BE USED FOR A FULL OR PARTIAL LOAD.
3. A TOTAL OF THIRTY-TWO WEB STRAP TIEDOWN ASSEMBLIES ARE REQUIRED FOR THE LOAD SHOWN.
4. THE LOAD SHOWN MAY BE POSITIONED ANYWHERE WITHIN THE LENGTH OF THE TRAILER. ALSO, THE QUANTITY OF PALLETS IN EACH ROW MAY BE CHANGED AS DESIRED. FOR EXAMPLE, THERE COULD BE SIXTEEN ROWS OF FIVE PALLETS EACH AND ONE ROW OF FOUR PALLETS. SEE SPECIAL NOTE 12 ON PAGE 6.

(CONTINUED BELOW)



ISOMETRIC VIEW

(LOAD GUIDANCE NOTE CONTINUED)

5. THE TRAILER IS EQUIPPED WITH TWO DIFFERENT TYPES OF TIEDOWN ANCHORS AS INDICATED IN THE "ISOMETRIC VIEW" ON THIS PAGE. THE LOAD SHOWN ON THIS PAGE REQUIRES THE USE OF FORTY-SIX TYPE I REMOVABLE TIEDOWN ANCHORS (TWENTY-THREE ON EACH SIDE OF THE TRAILER). SEE SPECIAL NOTE 11 ON PAGE 6.

KEY NUMBERS

- ① WEB STRAP TIEDOWN ASSEMBLY (28 REQD). INSTALL EACH STRAP TO EXTEND FROM A TIEDOWN ANCHOR ON SIDE OF TRAILER, OVER TOP OF PALLETIZED UNITS, TO A TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE TRAILER. TAKE UP EXCESS SLACK IN STRAP AND THEN RATCHET TIGHT. SEE GENERAL NOTES "F" AND "G" ON PAGE 2, SPECIAL NOTES 7 AND 9 ON PAGE 6, AND LOAD GUIDANCE NOTE 3 ON THIS PAGE.
- ② WEB STRAP TIEDOWN ASSEMBLY (4 REQD). INSTALL EACH STRAP TO EXTEND FROM A TIEDOWN ANCHOR ON SIDE OF TRAILER, AROUND THE PALLETS ON TOP OF THE PALLET BASE, AGAINST THE BASE OF THE PROJECTILES, TO A TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE TRAILER. TAKE UP EXCESS SLACK IN STRAP AND THEN RATCHET TIGHT. SEE GENERAL NOTES "F" AND "G" ON PAGE 2, SPECIAL NOTE 8 ON PAGE 6, AND LOAD GUIDANCE NOTE 3 ON THIS PAGE.

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
PALLETIZED 155MM SLP	84	66,948 LBS

LOADING, TIEDOWN, AND UNLOADING PROCEDURES FOR BOXED AMMUNITION AND COMPONENTS (PALLETIZED* AND UNPALLETIZED) IN/ON TACTICAL VEHICLES

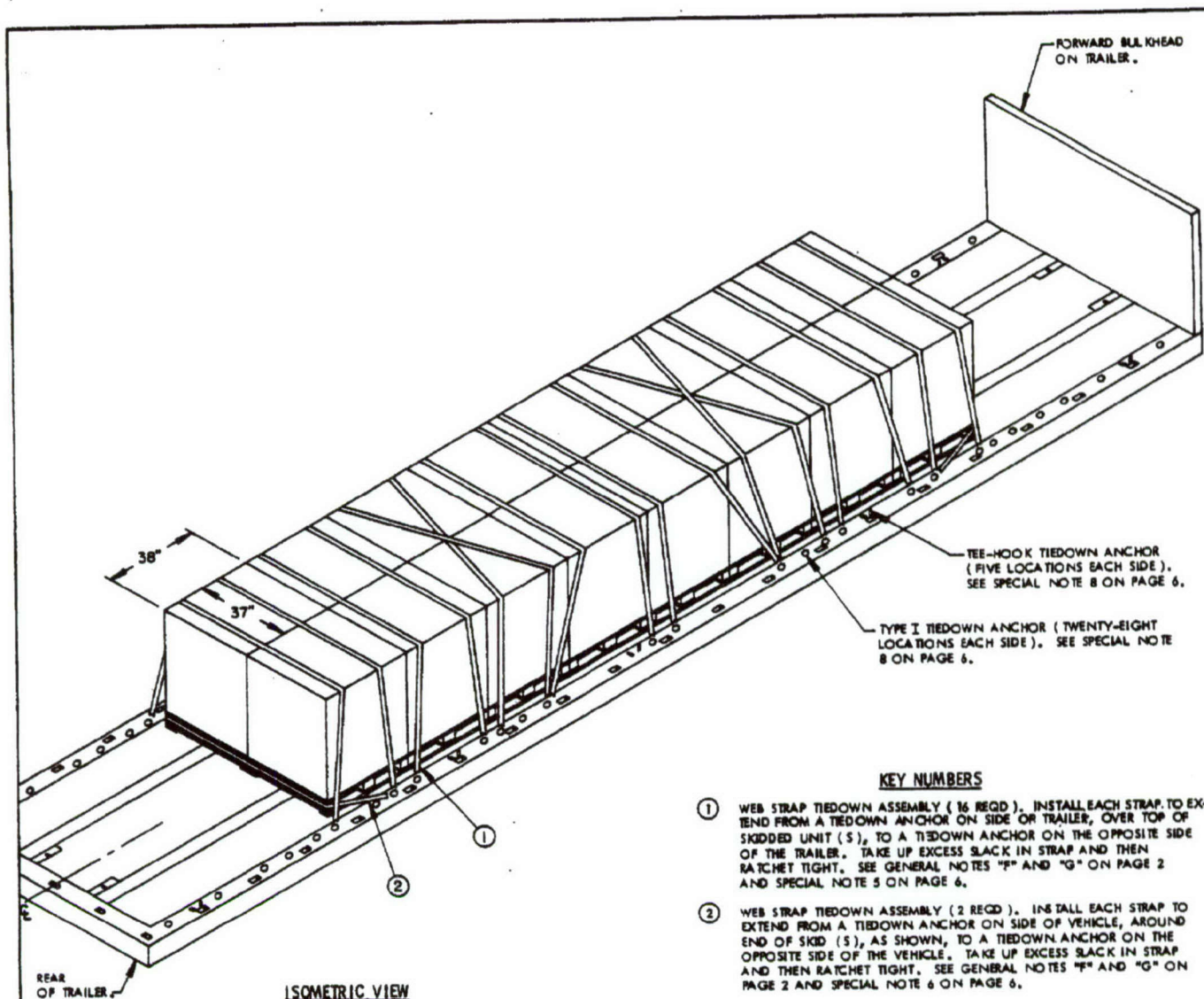
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SECUREMENT OF UNPALLETIZED BOXED AMMUNITION	-----	22-28
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* THROUGHOUT THIS PROCEDURAL DRAWING WHICH
INCLUDES PROCEDURES FOR BOTH PALLETIZED UNITS
AND SKIDDED UNITS, THE GUIDANCE SHOWN FOR ONE
TYPE OF UNIT MAY ALSO BE USED FOR THE OTHER TYPE.

REVISIONS		DESIGNED BY 204/105	PROJ. ENG. 204/105
		CHECKED BY W. J. Smith	LOG. ENGINEERING W. J. Smith
		APPROVED BY John L. Reynolds	
		U.S. ARMY AMC DRAWING	
		JULY 1987	
CLASS	DIVISION	DRAWING	FILE
19	48	4901/4	CA 17Q2

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PROJECT CAP-TV 34-79



KEY NUMBERS

- ① WEB STRAP TIEDOWN ASSEMBLY (16 REQD.). INSTALL EACH STRAP TO EXTEND FROM A TIEDOWN ANCHOR ON SIDE OF TRAILER, OVER TOP OF SKIDDED UNIT (S), TO A TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE TRAILER. TAKE UP EXCESS SLACK IN STRAP AND THEN RATCHET TIGHT. SEE GENERAL NOTES "F" AND "G" ON PAGE 2 AND SPECIAL NOTE 5 ON PAGE 6.
- ② WEB STRAP TIEDOWN ASSEMBLY (2 REQD.). INSTALL EACH STRAP TO EXTEND FROM A TIEDOWN ANCHOR ON SIDE OF VEHICLE, AROUND END OF SKID (S), AS SHOWN, TO A TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE VEHICLE. TAKE UP EXCESS SLACK IN STRAP AND THEN RATCHET TIGHT. SEE GENERAL NOTES "F" AND "G" ON PAGE 2 AND SPECIAL NOTE 6 ON PAGE 6.

LOAD GUIDANCE NOTES:

1. A PARTIAL LOAD OF SIXTEEN SKIDDED UNITS OF BOXED AMMUNITION IS SHOWN ON A SEMITRAILER, 34-TON, M872, HAVING DIMENSIONS OF 489-1/2" LONG BY 96" WIDE. NOTE: THE MAXIMUM LOAD IS BASED ON THE DIMENSIONS OF THE SKIDDED UNITS SHOWN.
2. THE TRAILER SHOWN WAS SELECTED AS TYPICAL ONLY, AND TRAILERS OF OTHER DIMENSIONS, WHICH HAVE A SUFFICIENT QUANTITY OF TIEDOWN ANCHORS LOCATED ALONG THE SIDE, MAY BE USED TO TRANSPORT THE LOAD SHOWN, OR A PARTIAL LOAD.
3. SIXTEEN SKIDDED UNITS OF BOXED AMMUNITION HAVING DIMENSIONS OF 37" WIDE BY 38" LONG BY 47-1/2" HIGH, ARE SHOWN AS A TYPICAL LOAD. IF LOADING SKIDDED UNITS OF OTHER ITEMS, SIZES, OR QUANTITIES, FOLLOW THESE SAME PROCEDURES.
4. THIS TRAILER IS EQUIPPED WITH TWO DIFFERENT TYPES OF TIEDOWN ANCHORS AS INDICATED IN THE "ISOMETRIC VIEW" ON THIS PAGE. THE LOAD SHOWN ON THIS PAGE REQUIRES THE USE OF THIRTY-TWO TYPE I REMOVABLE TIEDOWN ANCHORS (SIXTEEN ON EACH SIDE OF THE TRAILER). SEE SPECIAL NOTE 8 ON PAGE 6.
5. A TOTAL OF EIGHTEEN WEB STRAP TIEDOWN ASSEMBLIES ARE REQUIRED FOR THE LOAD SHOWN ABOVE. SEE "LOADING, TIEDOWN, AND UNLOADING PROCEDURES" NOTE 4 ON PAGE 5.
6. IF AN UNEVEN QUANTITY OF SKIDDED UNITS ARE BEING LOADED, SUCH AS FIFTEEN, POSITION ONE SKIDDED UNIT IN THE CENTER OF THE TRAILER WIDTH AND TIGHT AGAINST THE REAR TWO LATERALLY ADJACENT SKIDDED UNITS, AS SHOWN IN THE LOAD ON PAGE 11.
7. WHEN LOADING ONE SKIDDED UNIT ON A TRAILER, POSITION THE SKIDDED UNIT IN THE CENTER OF THE TRAILER WIDTH AND IN A LONGITUDINAL LOCATION THAT WILL ALLOW TWO STRAPS TO BE POSITIONED OVER TOP OF THE SKIDDED UNIT AND ONE STRAP AROUND THE SKID BASE AT EACH END. USE THE LOAD ON PAGE 10 FOR GUIDANCE.

(CONTINUED AT RIGHT)

(LOAD GUIDANCE NOTES CONTINUED)

8. IF IT IS DESIRABLE TO LOAD A ROW OF TWO OR MORE SINGLE SKIDDED UNITS DOWN THE CENTER OF THE TRAILER LENGTH, USE THE LOAD ON PAGE 10 FOR GUIDANCE. NOTE: ONE ADDITIONAL STRAP MARKED ② WILL BE REQUIRED, AROUND THE SKID BASE, AT THE FORWARD END OF THE LOAD.

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
SKIDDED UNIT	16	28,000 LBS (APPROX)

SKIDDED UNIT OF BOXED AMMUNITION LOADED ON A SEMITRAILER, 34-TON, M872

PAGE 19